Class Design Problem
CEE 498FM
Written Report Due August 1, 2007
Oral Presentation Due August 6, 2007

**Background**

The Salt Fork River (figure 1) has its headwaters in Champaign County and flows through Champaign and Vermillion County before it joins with the North Fork of the Vermillion to form the Vermillion River at Danville, Illinois. The Salt Fork River basin has been anthropogenically altered, not only by the intensive row-crop agriculture, but also by the installation of tile drains and drainage ditches to allow for increased drainage. Prior to the mid to late 1800's, this land was poorly drained and considered un-inhabitable because of the swampy nature of the land. In the late 1800's and early 1900's, channels were dredged into the landscape and tile drains were installed in the fields as aids to drainage. This has allowed for intense agriculture use of the lands in the watershed. Periodic maintenance dredging continues today, albeit with increased controversy as environmental interest have tried to decrease the dredging. The latest dredging (figure 1, see Dredge Phase 1) has stirred considerable controversy as phase 1 has been completed in 2005 with the wholesale removal of trees lining the river. Phase 2 is being scheduled for 2007-2008 time frame. Urbanization also plays a large role in the hydrology of the Salt Fork The low flow for the upper reach is dominated by waste-water effluent from three waste water treatment plants (WWT) (figure 1). Urbana stormwater runoff from Champaign-Urbana is conveyed to the Salt Fork via the Saline Drainage ditch and the St. Joseph Number 3 Drainage District Ditch. Other municipalities serving as sources of urban stormwater are Rantoul, St. Joseph, Philo, and Sidney. In 2002, an Ammonia spill at the University of Illinois Abbott Power plant resulted in a large fish kill along the Saline Drainage Ditch and the Salt Fork.

A Total Maximum Daily Load (TMDL) study is ongoing in the Salt Fork as various reaches failed to meet designated uses because of water quality impairment. The most common water quality impairments in the Salt Fork River are elevated nutrients (Nitrogen and Phosphorus) and excessive sediment. In addition, due to increased recreational use of the Salt Fork, the WWTP in the upper basin will soon be required to disinfect summer-time effluent discharges.

**Problem:**

The reach of interest for the class project is shown on figure 4. We have to design a data collection effort and analyze existing data to gain insight into potential solutions for the following issues:

1) This reach of the Salt Fork is being investigated for potential stream restoration projects.
2) As part of the ongoing TMDL process, we need to collect some additional information to fill in the gaps in data to determine the status of water quality in this reach.

3) Lastly, the Salt Fork has been mentioned as a potential source of water supply for the Village of Sidney, IL.

**Report Scope and Requirements:**

1. Determine the level of bacteria impairment (fecal coliform) of the Salt Fork in the reach of interest downstream of the St. Joseph WWTP. Research the current Illinois EPA standards and report on both the magnitudes of the current bacteria levels and the spatial variability and die-off rates downstream of the St. Joseph WWTP. Is the St. Joseph WWTP meeting its current permit requirements? As part of the class you will assist in collecting samples to analyze for fecal coliform and use this data along with any IEPA data you can find on-line to make your determination.
2. As part of the TMDL investigation, investigate the temperature data from St. Joseph versus the Sidney gage and comment on what you see in regards to spatial and temporal variation in the temperature data. What are the causes for these differences?
3. Examine the continuous (15 minute) Dissolved Oxygen data that will be collected during the 2 weeks of this class. Comment on the temporal variability and the causes for this variability.
4. Given that excess sediment is an impairment to water quality to this reach, determine an estimate of the annual sediment load and the max and min daily concentrations and loads during the time of data collection.
5. Determine how the low-flow hydrology is being impacted by the 3 WWTP effluents. Compare the $10^{th}$ percentile flow for the period of record for the Salt Fork near St. Joseph, IL streamflow gage with the data collected over the last year at the new streamflow gaging station on the Salt Fork near Sidney, IL. Are there any trends in WWTP effluent as a percentage of total flow at the two sites?
6. Looking at the flow duration curves (FDC) for both the long-term gaging station at St. Joseph and the new gaging station at Sidney, synthetically extend the flow record at Sidney to give an estimate of the FDC at Sidney for use in the water-supply study for Sidney.
7. As part of the stream restoration investigation, bank and bed stability have to be determined. Using the velocity data collected from the various sources you have at your disposal: Nortek Acoustic Doppler Velocimetry (ADV) data, FlowTracker data, ADCP data, compute the near bed shear stress at the various locations. Comment on the spatial variability in shear stresses.
8. As part of the stream restoration investigation, estimate the bank-full streamflow discharge.
9. As part of the stream restoration investigation, it is thought that a wetland will be a good enhancement to the ecosystem in the reach where the GeoProbe collected sediment cores and a shallow observation well was installed. Using:
    a. the GW data collected during the two weeks,
    b. the anecdotal evidence supplied by the landowner,
    c. the stage data from the stream,
    d. the flow duration curve, and
    e. the elevation and flow for bank-full discharge,

give your estimate of the viability of a constructed wetland in the floodplain at the location of the gaging station.

**Grading For Class:**

Your grade will be based on three parts:

1. Class participation
2. Oral Presentation
3. Written Report

The written report should summarize your findings that answer the items listed in the Report Scope. In addition to the data you collect as part of this course, it will be helpful to access historic data and other reference material on the web. The Illinois EPA ambient water quality data has been collected at various locations along the Salt Fork. You may access that data at http://il.water.usgs.gov/proj/wqinfo/index.html or http://maps.epa.state.il.us/website/wqinfo/

The current listing of the causes of impairment and the current TMDL for the Salt Fork River can be found online at:
http://www.epa.state.il.us/water/tmdl/report-status.html#salver

Historic flow data for the various USGS gages in this watershed can be found at USGS:
http://pubs.usgs.gov/wdr/2005/wdr-il-05/start.htm

Each person is required to give an Oral Presentation that can be no longer than 10 minutes in length.